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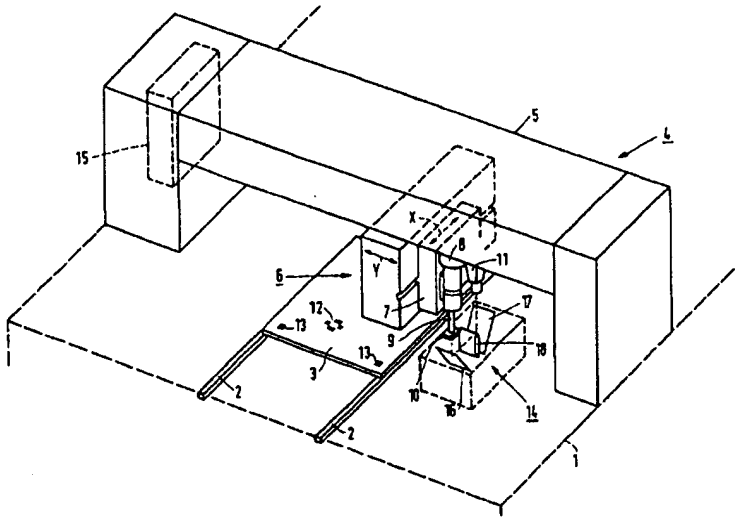
(54) Title: METHOD OF PLACING A COMPONENT ON A CARRIER, AND COMPONENT PLACEMENT MACHINE FOR IMPLEMENTING SAID METHOD



(57) Abstract

The invention relates to a method and to a component placement machine for placing a component (10) on a carrier (3), by which method the carrier is subjected to an optical detection by means of an imaging device (11) fixedly connected to a placement head (8) and designed to determine the position where the component is to be placed on the carrier, and by which method the component (10) is also subjected to an optical detection for determining the position of the component (10) after it has been picked up by a placement head (8). The optical detection of the component is achieved by means of the same imaging device (11) so as to achieve that the position of the component (10) and the location (12) where the component is to be placed on the carrier are determined in as simple a manner as possible.

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Method of placing a component on a carrier, and component placement machine for implementing said method.

The invention relates to a method of placing a component on a carrier, by which method the carrier is subjected to an optical detection by means of an imaging device fixedly connected to a placement head and designed for determining the position where the component is to be placed on the carrier, and by which method the component is also subjected to an optical detection for determining the position of the component after the latter has been picked up by the placement head.

Such a method is known from US-A-5,084,959. The position of the component is determined in this known method by means of a separate imaging device which is fixedly connected to the frame of the placement machine.

It is an object of the invention to determine both the position of the component and the place where the component is to be placed on the carrier in as simple a manner as possible.

The invention is for this purpose characterized in that the optical detection of the component is carried out by means of said imaging device.
The advantage of this method is that the imaging device for the component and the placement head are fastened to the same arm of the robot, so that placement inaccuracies caused by the robot movement are eliminated. The calibration of the placement head, usually the centreline of the placement head, relative to the imaging device is much simpler now.

Preferably, the image of the component is obtained by means of an optical deflection system.

The invention also relates to a component placement machine with a frame, a robot, a transport system for transporting carriers, a placement head for placing components which is fastened to an arm of the robot, and an imaging device also fastened to the arm of the robot for detecting marks on the carrier. To render the placement machine simpler and also more accurate, it is provided with an optical deflection system for making an image of the component by means of said imaging device. The placement machine now

has only one imaging device by which an image of both the marks and the carrier can be made for determining the exact position where the component is to be placed on the carrier, and for making an image of the component for determining the component's position. A simple optical system only is necessary for the latter function. For example, two mirrors and a lens are used as the optical system.

The invention will now be explained with reference to an embodiment shown in a drawing in which:

Fig. 1 shows a component placement machine for carrying out the method, and

Fig. 2 shows an optical deflection system formed by two reflecting surfaces of a prism and a lens for use in the placement machine of Fig. 1.

A transport system for the transport of printed circuit boards 3 is present on the frame 1 of a component placement machine, of which system only the transport rails 2 are shown. Above the transport rails there is a component placement unit 4 formed by a U-shaped frame 5 to which an X-Y robot 6 is fastened. The X-Y movement of the robot 6 is shown with arrows. Alternatively, the robot movement may be a ϕ,r movement. A placement head 8 capable of placing components on the carrier is fastened to an arm 7 of the robot. The placement head has a suction nozzle 9 with which components 10 can be taken up from a feeder and placed on the carrier 3. A component imaging device 11 is also fastened to the arm 7. It is necessary for an exact placement of a component on the carrier that the exact position of the location 12 where the component is to be placed on the carrier should be known. This is achieved in that an image is taken of certain marks (fiducials) 13 present on the carrier. The relative position of the location where the component is to be placed on the carrier with respect to such marks is known in advance. The data of the image taken of the marks' position are passed on to the image processor 15, where they are compared with data stored in the processor so that any deviations can be calculated.

The imaging device 11 is also used for determining the relative position of the component 10 with respect to the suction nozzle 9. For this purpose, the arm 7 with the placement head 8 and the imaging device 11 is positioned above an optical system 14 such that an image can be taken of the component held by the suction nozzle via this system. Said system has two mirrors 16, 17 for this purpose, between which a lens 18 is arranged. The correct position of

the component can be determined thereby. The position data are sent to the image processor 15 again and compared with data stored in the processor. These data in conjunction with the data on the position where the component is to be placed on the carrier now render it possible to control the robot 6 with the placement head 8 such that the component will occupy the desired position. Only one imaging device with a simple optical deflection system is accordingly necessary for an accurate placement of a component. The mirrors may alternatively be formed, for example, by two reflecting surfaces of a prism 19 (see Fig. 2). The lens 38 serves for adapting the image field and for a correct adjustment of the focal distance.

CLAIMS:

1. A method of placing a component on a carrier, by which method the carrier is subjected to an optical detection by means of an imaging device fixedly connected to a placement head and designed for determining the position where the component is to be placed on the carrier, and by which method the component is also subjected to an optical detection for determining the position of the component after the latter has been picked up by the placement head, characterized in that the optical detection of the component is carried out by means of said imaging device.

2. A method of placing a component on a carrier as claimed in Claim 1, characterized in that the image of the component is obtained by means of an optical deflection system.

3. A component placement machine with a frame, a robot, a transport system for transporting carriers, a placement head for placing components which is fastened to an arm of the robot, and an imaging device also fastened to the arm of the robot for detecting marks on the carrier, characterized in that the placement machine is provided with an optical deflection system for detecting the position of the component by means of said imaging device.

4. A component placement machine as claimed in Claim 3, characterized in that the optical deflection system is formed by two reflecting surfaces and a lens.

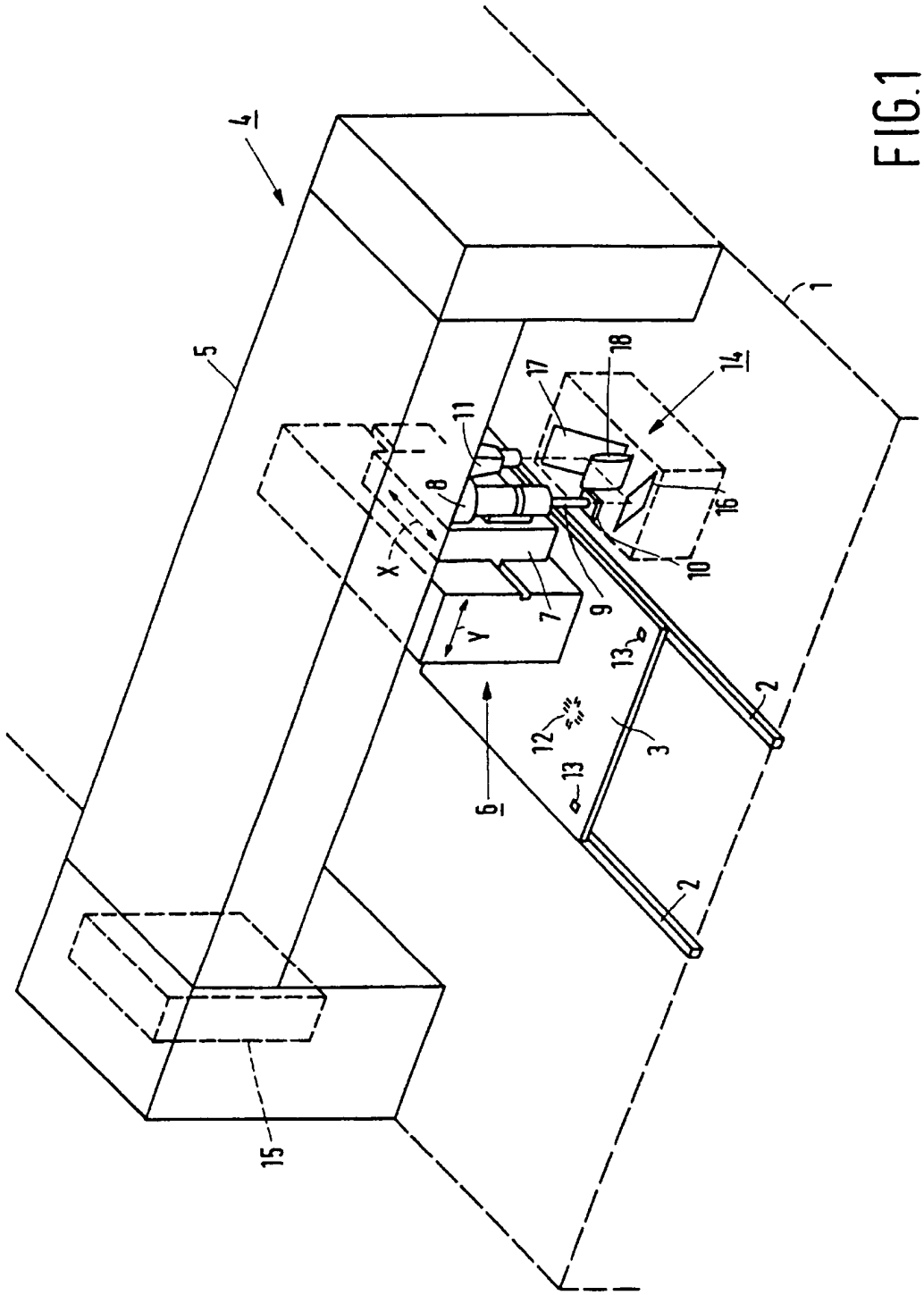

FIG.1

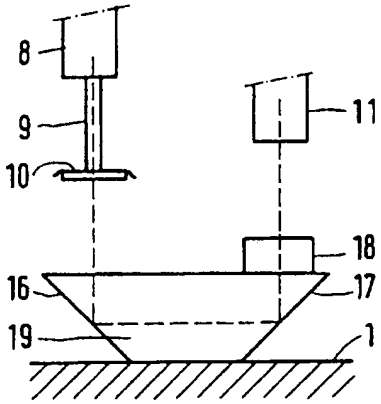

FIG.2

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H05K 13/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5216804 A (W.J. ROSIER ET AL.), 8 June 1993 (08.06.93), figure 5	1,3
A	US 5369493 A (M. TOMITA ET AL.), 29 November 1994 (29.11.94), abstract	1-4
A	US 5249356 A (O. OKUDA ET AL.), 5 October 1993 (05.10.93), figure 2	1-4
A	US 5084959 A (T. ANDO ET AL.), 4 February 1992 (04.02.92), abstract	1,3

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5216804 A	08/06/93	EP 0514975 A	25/11/92
		JP 5198994 A	06/08/93
US 5369493 A	29/11/94	DE 69116709 D,T	06/02/97
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US 5249356 A	05/10/93	JP 4291795 A	15/10/92
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